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April 28, 2005

EFCOG SAWG 2005 Workshop
Santa Fe, NM, United States
May 2, 2005 through May 5, 2005

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Implementation of a New Nonnuclear Standard at LLNL

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EFCOG Safety Analysis Workshop, April 29 - May 5, 2005**

Abstract

The objective of this paper is to introduce the process and philosophies used to implement the new Work Smart Standard (WSS), "Safety Basis Requirements for Nonnuclear Facilities at Lawrence Livermore National Laboratory Site Specific Standard" (UCRL-ID-150214), approved in 2003 and revised January, 2004.

This work relates directly to the following workshop theme: "Improvements in Chemical, Biological, and Non-nuclear Safety Analysis."

This paper will describe the approach used to implement the new nonnuclear standard at LLNL and corresponding guidance manual: *ES&H Manual*, Document 3.1. The varied activities can be broken down into three main parts:

- **Implementation Plan Schedule.** The Implementation Plan includes the due dates for revising nonnuclear facility safety analysis documentation to meet the new standard. Implementation of the new methodology is being phased over a 4-year period. Each directorate was tasked to schedule the revision date for each of their nonnuclear facilities, using agreed upon priority-ranking criteria.
- **Program Infrastructure.** This includes the development of training courses, procedures, a website and tools required to perform the work (i.e. Q List, de minimus list) or tools helpful to perform the work; such as a program to automate the classification of chemical inventories and establish maximum facility inventory limits (MFILs).
- **Delegation request packages.** NNSA agreed to grant delegation to LLNL for local approval of nonnuclear safety basis documents (SBDs) in a phased manner. The first package submitted was for the Tier 1 (or Screening Report SBDs), the next is for the Tier 2 SBDs, and the last package will include the Tier 3 SBDs. The packages generally include 2-4 example SBDs at the level for which NNSA delegation is being sought, relevant training course material, and applicable procedures.

The Implementation Plan was approved by LLNL's Deputy Director of Operations (DDO) in August 2004 and will be reviewed, updated, and re-approved, as necessary, on a 6-month basis. All listed program infrastructure items are in place, except the Chemical Classification tool (which is 90% complete). Full delegation approval for the Tier 1 SBDs is anticipated from NNSA in early May, 2005, and the Tier 2 SBD package is 90% complete and will be submitted to NNSA in the near future.

This paper illustrates the myriad of tasks necessary to implement a new Nonnuclear program, and provides a strategy for implementation that includes input from stakeholders and also provides the necessary guidance, training and tools needed to achieve a smooth transition.

Introduction

Lawrence Livermore National Laboratory is in the process of implementing a new nonnuclear safety analysis program in a phased approach, to be fully in place by December 31, 2008. The new methodology covers 5 nonnuclear hazard types: chemical, explosive, radiological, industrial and biohazard. The general philosophy considers human health effects, based upon a graded approach. Appendix A provides a flowchart summary of the nonnuclear analysis and documentation process. This paper will address the status of LLNL's implementation of the new nonnuclear program.

The implementation effort includes: the development of three training courses; a website; procedures; the Chemical Inventory Quantity list (Q List) that is based on Temporary Emergency Exposure Limits (TEELs); screening and change control processes and forms; and a chemical classification tool. NNSA/LSO agreed to grant delegation to LLNL for local approval of nonnuclear safety basis documents in a phased manner, by hazard level. The current status of this effort will also be addressed.

Implementation Plan

A commitment was made between NNSA/LSO and LLNL management that the nonnuclear facilities at LLNL would be analyzed to the new standard in a phased manner in accordance with an implementation plan. All nonnuclear facilities are to be compliant by December 31, 2008. An agreement was made that facilities should be prioritized as follows:

1. Nonnuclear facilities located within 100 meters from a nuclear facility
 2. Nonnuclear facilities located within 100 meters from a public fenceline
 3. Nonnuclear facilities located within 100 meters from a explosive facility
 4. Nonnuclear facilities located that have a EHPA
- N/A Nonnuclear facilities not meeting any of the above conditions are "non-prioritized" and may be complete last (but before December 31, 2008).

Each LLNL Directorate was tasked with developing their own schedule for completing their nonnuclear facilities to the new standard, in accordance with the priority ranking system. Their draft schedules were submitted to LLNL's Authorization Basis Section for resource leveling. Any AB Section requests for modifications were negotiated with each Directorate prior to finalizing the overall Implementation Plan schedule. The final Implementation Plan schedule was approved by the LLNL Deputy Director of Operations (DDO) and then forwarded to NNSA/LSO for concurrence.

The IP provides instructions on how changes may be made to the schedule. Extensions requests for the due-dates of priority-ranked facilities must be approved by the DDO on a semi-annual basis. Changes to the schedule of non-prioritized facilities may be made without such approval; however, the expectation exists for the directorates to interchange schedules with another non-prioritized facility scheduled at a later date. The semi-annual

IP schedule review reflects all such changes and also indicates any other changes in facility status, such as: facilities to be removed from the list due to Decontamination & Decommissioning (D&D) activities or downgrades to Office-level facilities.

Program Infrastructure Development

As with all new programs, many guidance documents, training courses and tools had to be developed before the program could begin to be implemented.

Training

Three training courses were developed for the new nonnuclear program:

- HS8050 Overview of ES&H Manual Document 3.1
- HS8051 Preparing Facility Screening Reports
- HS8060 Non-Nuclear Safety Analyses

The first course, HS8050 provides a general overview of the nonnuclear program requirements. It is geared toward ES&H Team Leaders and their deputies, Assurance Managers, and directorate-designated facility management. In general, all workers with roles and responsibilities for generating, maintaining, and ensuring compliance with safety basis documents for non-nuclear facilities are required to take this course. As of May, 2005, the course has been offered 12 times, and approximately 200 LLNL and NNSA/LSO employees have been trained so far. This course also serves as a pre-requisite to the second class HS8051.

HS8051 is required for individuals who prepare facility screening reports. The screening report is the first level safety basis document (SBD) for nonnuclear facilities, and therefore also known as a Tier 1 SBD. The key purpose of this Tier 1 Safety Basis Document (SBD) is to record the identification of hazardous operations and inventories present within the facility, and to document the hazard classification for each hazard type and the final facility classifications. It is the only safety basis document required for Light Science & Industry facilities and is also used as the first chapter for facilities classified as Low, Moderate and High hazard. Students in this class learn how to identify and classify hazards, and how to complete the facility screening forms. This course has been offered 12 times so far and approximately 115 individuals have been trained. This course serves as a pre-requisite for the HS8060 course.

The third course in the series, HS8060 Nonnuclear Safety Analyses, focuses on hazard analysis, accident analysis, and controls for nonnuclear facilities. It is required for employees who conduct hazard analysis, accident analysis and control selection for non-nuclear facilities (i.e., those who prepare Tier 2 or Tier 3 safety basis documents), primarily Safety Analysts. This two-day course has been offered 3 times, with approximately 25 individuals trained so far.

Procedures

Several procedures have been developed to provide guidance on how the nonnuclear standard is to be implemented. The main guidance document is found within LLNL's institutional *ES&H Manual*, Document 3.1. This document is the primary guidance resource on how the nonnuclear standard is to be implemented. It includes detailed information on the hazard types, screening and analysis process, documentation and training requirements, how to deal with nonconformance, and other topics.

There is also a topic specific procedure detailing how to develop a facility screening report (Tier 1 Safety Basis Document), "Facility Hazard Screening Procedure" (AB/NN-101, Rev 1, 08-25-04).

Another topic specific procedure is being developed to address the "how-to" of nonnuclear hazards analysis, accident analysis and control selection.

Website

A website was developed for the Nonnuclear Safety Basis Program that is accessible to all LLNL employees. The website provides a high level overview of all key aspects of the nonnuclear program with hyperlinks to *ES&H Manual*, Document 3.1 for more specific details. Therefore this website serves as a navigational tool. The website also contains a variety of resources needed to complete nonnuclear requirements; such as forms for conducting facility screening and change control; Chemical Inventory Quantity List (Q List); Chemical de minimis list, and hyperlinks to pertinent reference documents.

Chemical Quantity Inventory listing (Q List)

Facilities are classified according to the potential for their operations to impact collocated workers (at 100 meters from the release source) and the public (at the nearest site boundary), based on the effect of unmitigated releases of hazardous energy or materials.

For chemicals hazards the TEEL values at the receptor site were back-calculated to allowable facility chemical inventories. The receptor site for the public is considered the nearest Site boundary, and for collocated worker, 100 meters from release site. EPI code calculations determine the chemical inventory quantity (Q value) for each chemical that, if released, would result in exposures equal to the TEEL values at fixed distances from the release point.

The Q values were developed by EPI code for LLNL Main-site facilities located 100, 200, 300, 600 meters from the nearest off-site fence-line (LLNL Site 300 facilities additionally include 1100 meters), using 50 % meteorological conditions. Facilities located in between these distances use the more conservative of the two distances adjoining their facility (e.g. a facility located 260 meters from the offsite fence-line uses the Q values within the 200 meter columns of the Q List).

To obtain the collocated worker value, the 100 meter values are used. The chemical hazard classifications are determined using Table 1.

Table 1 Chemical Hazard Classifications

Facility Classification	Colocated Worker Impact	Public Impact
Light Science & Industry (LSI)	No more than mild, transient adverse health effects or the perception of a clearly defined objectionable odor or sensation. \leq TEEL-1 & \leq Q-1	No appreciable risk of health effects \leq TEEL-0 & \leq Q-0
Low Hazard	No irreversible or other serious health effects or symptoms that could impair a person's ability to take protective action. \leq TEEL-2 & \leq Q-2	No more than mild, transient adverse health effects or the perception of a clearly defined objectionable odor or sensation. \leq TEEL-1 & \leq Q-1
Moderate Hazard	Irreversible or other serious health effects or symptoms that could impair a person's abilities to take protective action. \leq TEEL-3 & \leq Q-3	No irreversible or other serious health effects or symptoms that could impair a person's ability to take protective action. \leq TEEL-2 & \leq Q-2
High Hazard	Potential for unmitigated release of hazards with impacts to colocated workers that are believed to include life-threatening health effects. $>$ TEEL-3 & $>$ Q-3	Irreversible or other serious health effects or symptoms that could impair a person's abilities to take protective action. $>$ TEEL-2 & $>$ Q-2

Note that the public is protected at a higher level than the colocated worker, because the colocated worker is assumed to be covered by the LLNL emergency protection program.

De Minimis list

LLNL established optional de minimis quantity levels for hazardous materials, particularly chemicals, below which a material is not considered to be part of the facility inventory for safety analysis purposes. The de minimis concept can be used to avoid unnecessary effort associated with containers having only small quantities of materials that would not have an adverse effect on colocated workers and the public.

Different chemicals will have different de minimis quantities, depending upon their potential human health effects. De minimis guidance is found in Table 2.

Table 2 De minimis Quantities for Chemicals.

Chemical class	De minimis quantity
Highly Hazardous Chemicals	
Listed in The Nonnuclear Safety Basis Program Website	See Website
Not listed in Appendix D but documented to be highly hazardous or a suspected unknown.	10 g or analogous De Minimis List (See Website) values ^{1,2}
All Other Chemicals	
1. Already assigned a Q value; or (2) not assigned a Q-value but not highly hazardous or a suspected unknown.	1 kg
1. Already assigned a Q value with a Q0(100m) of 10,000 kg; or 2. Not assigned a Q value but analogous to a chemical with a Q0(100m) of 10,000 kg. ¹	10 kg
Materials on the ChemTrack Priority 3 and 4 list (this list includes common materials such as adhesives, degreasers, and household materials) but not including pesticides and herbicides.	10 kg
Nonreactive metals (such as copper, steel, and aluminum, but not including magnesium, sodium, and so forth) in nonpowder forms (such as wire, sheets, ingots). ³	1000 kg

- 1 Contact your ES&H team Industrial Hygienist for assistance in making the determination of analogous chemicals.
- 2 If using an analog to a listed chemical, use the de minimis of the analogous listed chemical.
- 3 Metal used in buildings, machinery, or the scrap metal yard are not subject to analysis and are therefore automatically excluded from inventory.

Chemicals assigned TEEL values low enough to be deemed highly hazardous are placed on a special de minimis list. Chemicals are placed on this list when the Q1 value at 100 meters on the standard Q tables for site 200 or Site 300 is <20 Kg. The de minimis value is derived from the Q0 at 100 meter value, which is divided by a factor of 20, down to a generic minimum of 10 grams. This list is stored on the Nonnuclear Safety Basis Website under the *Resources* Tab.

Chemical Classification Program

A Chemical Classification Program has been developed to automate the process of developing inventory limits (Maximum Facility Inventory Limits – MFILs) for chemicals, per desired classification level. This system has been integrated with LLNL’s chemical inventory tracking system, ChemTrack.

In brief, the Chemical Classification Program works as follows:

- The user identifies the LLNL Site (200 or 300), the Facility number and the approximate distance to the nearest fenceline.
- The user selects all chemicals or only chemicals that exceed de minimis values

- The program then draws the chemical inventory data from ChemTrack as specified
- Additional chemicals may be added to the listing at this point to account for planned project for which chemicals have not yet been ordered or for chemicals currently at de minimis levels but anticipated to be required at larger quantities in the future.
- Once the chemical list is complete, the user chooses the analysis tab, and the inventory levels are automatically calculated at each classification level. The user can then compare the actual current facility inventory for each chemical against the limit for LSI, Low, Moderate and High.
- Next, the user determines the appropriate Maximum Facility Inventory limit based on inventory needs and the desired classification level. The user can also choose to set the MFILs to the LSI classification (this will be the most common approach employed). If a few chemicals are required at a higher classification level, then the LSI based MFIL can be overridden with the value at the appropriate classification level.
- Once all MFILs are accepted, they are forwarded back to LLNL's ChemTrack System and inventory levels will then be monitored against these MFILs.

This program thus serves two key functions;

1. Classifies facility chemical inventories and eliminates the work involved if this function were to be done manually using the Q List; and
2. MFILs are developed for all facility chemicals and these are then forwarded to LLNL's ChemTrack system for on-going monitoring.

QA efforts are currently being conducted for both the Chemical Classification Program and the Nonnuclear Program enhancements within the ChemTrack system. Additionally, a change control enhancement is being added to the Chemical Classification Program. LLNL has also contracted with Doug Craig and Rocky Petrocchi to generate approximately 400 new TEELs for chemicals that are currently in LLNL's inventory above de minimis levels. We anticipate that this Chemical Classification Program with complete linkage to LLNL's ChemTrack System will be released for use in August 2005.

Delegation Request Status

NNSA/LSO is granting approval over the implementation approach for the new Nonnuclear Safety Basis Program in a phased manner. "Evidence" packages for documentation covering each of the classification levels are being submitted for review.

The office facility delegation request was the first classification level to be approved. LLNL was required to have all Office Level facilities classified and listed by May 3, 2004. This goal was reached.

LSI Delegation Request package was submitted to NNSA/LSO on September 3, 2004. The evidence package included training materials for the two applicable training courses (HS8050 and HS8051), completed screening reports for 4 LSI facilities and a screening procedure. Conditional approval was granted in December, 2004. Full approval is anticipated in early May, 2005.

The Low and Moderate Delegation Request Package will be submitted to NNSA/LSO next (after delegation for LSI is first obtained). Safety Basis Documents are undergoing final review for three Low hazard Facilities and one Moderate hazard facility. These SBDs will be submitted with the delegation request package that will also include instructor course materials for the HS8060 course and a procedure on doing hazard and accident analysis for nonnuclear facilities.

The high hazard delegation request package will then be submitted sometime after delegation to the lower classification levels is received.

Conclusion

A wide variety of projects are required to implement a new program. First of all, it is important to set a time-frame for change that is acceptable to both NNSA and LLNL Directorate management and personnel. What worked well was having Directorate management directly involved in creating their facility schedule, and providing them with a prioritization framework that met the needs of NNSA/LSO and senior LLNL management. This helps establish ownership in implementing the program.

The necessary training, informational resources and tools are also very important to put in place, and it is important to allow enough time for these endeavors.

References

Safety Basis Requirements for Nonnuclear Facilities at Lawrence Livermore National Laboratory, Site-Specific Work Smart Standard, Rev. 2, dated January 2004, UCRL-ID-150214.

Lawrence Livermore National Laboratory, UCRL-MA-133867, ES&H Manual, Document 3.1 "Nonnuclear Safety Basis Program", March 2004

Homann, S., Emergency Prediction Information Code (EPI Code), Homann Associates.

Appendix A

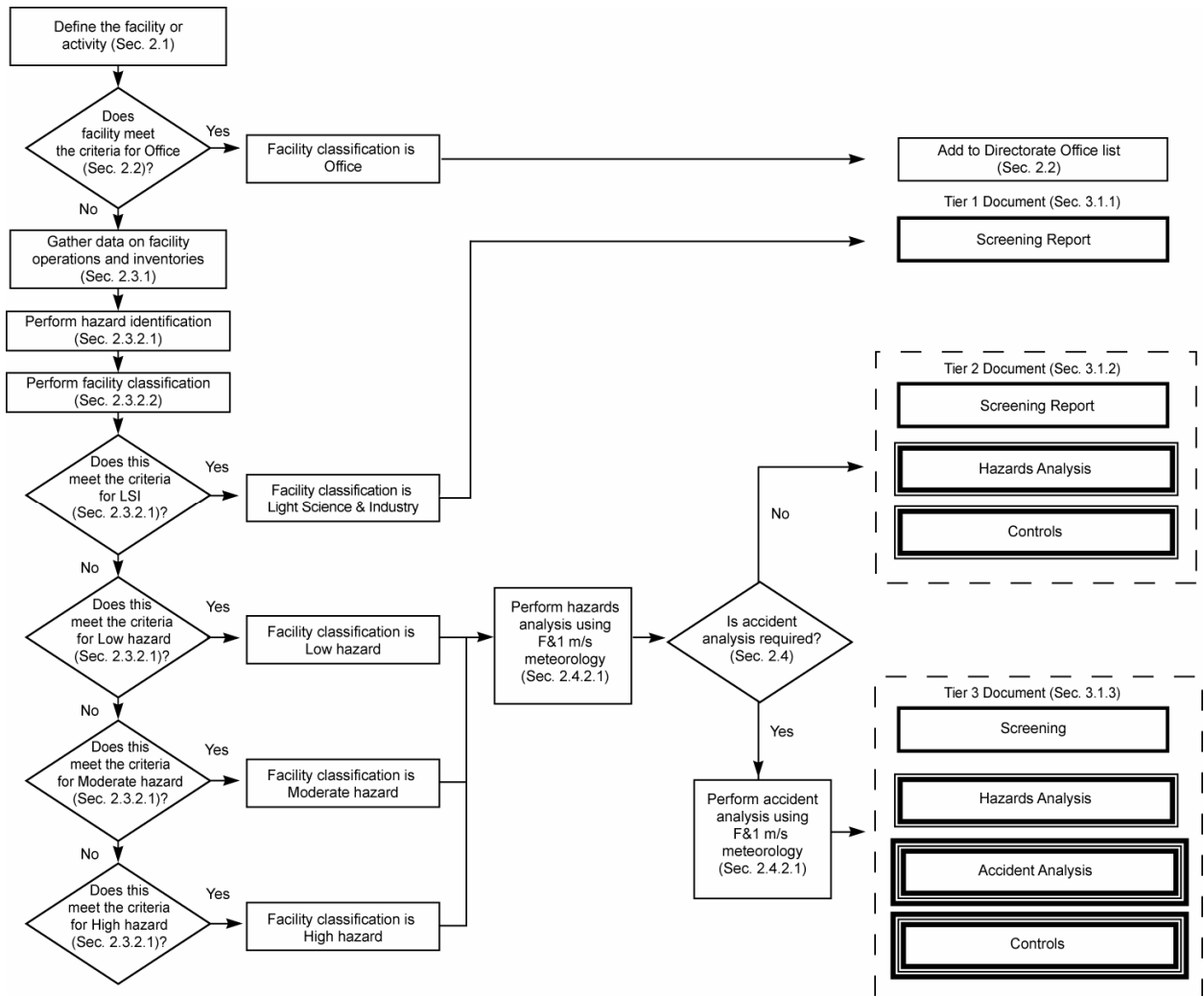


Figure 1 Nonnuclear Safety Analysis and Documentation Process

(Note: The sections called out in Figure 1 relate to sections within the LLNL guidance document: *ES&H Manual*, Document 3.1)